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VICTORIA, AUSTRALIA

BY ROBERT T. SAWYER, '23

[EDITOR'S NOTE.—Mr. Sawyer has just returned from a four months' trip around the world. Most of his time in Australia was spent in Victoria where the engineering projects held his interest. This article was written on board the ship from Melbourne to London.]

THE great island continent, Australia, is a remarkable land which has practically the same area as the United States but a population of only 5,500,000 people. A land of sunshine and flowers, it is a second California.

Victoria, the smallest state in the Commonwealth, aside from the island Tasmania, has one thirtieth the area of the 3,000,000 square miles in Australia. Even though so small, it has one quarter the total population.

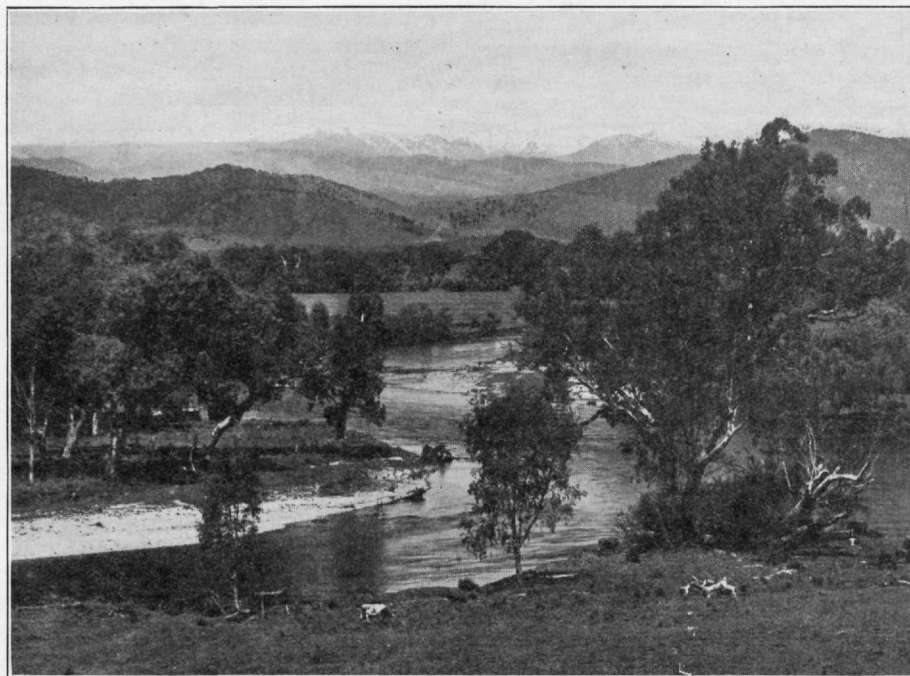
Victoria has a climate like that of northern California,

world. Probably the greatest boom Australia will ever know is when they find oil, and no doubt it is there. The fine towns of Bendigo and Ballarat in Victoria were started by the great Australian gold rush in 1850. Today, Bendigo and Ballarat stand amidst factories and waving golden fields of wheat. Today, Victoria has mined most of her gold and is well on her way towards permanent prosperity. And likewise the rest of Australia will in time be settled, first by the gold miner and later the farmer.

In the following paragraphs will be told chiefly the engineering developments in the state of Victoria, for this is where the author spent most of his time.

VICTORIAN RAILWAYS

The Victorian railways are entirely government owned and operated. The managing force and employees



ON THE UPPER MURRAY RIVER

with its flowers blooming all of the year around, yet in the winter months chilly enough to be invigorating.

Melbourne, the capital of Australia, which is also the capital of Victoria, is a busy, beautiful city of 800,000 people.

As we Americans do not usually realize the size of this continent in the south seas, the writer wishes to bring to the reader's attention the location of Melbourne. The center of population of Australia is close to Melbourne which is in the extreme southeastern section of the country. To travel in a direct line either to Perth on the west coast or directly to the north coast from Melbourne one would cover the same distance as from Columbus, Ohio to San Francisco and pass through all the principal cities and the thickly populated areas.

The greater part of Australia has been visited only by the mining and exploring parties. Practically all minerals have been found except oil. The conditions for obtaining gold and other minerals have generally been quite different from those in other parts of the

seem to have an unusually fine spirit of working together. This is largely due to the fact that these railways have been taken out of politics and are operated as a private company so that a profit must be shown. The service rendered on this system is given in the good American style of speed as well as comfort. The Chairman of Commissioners who is responsible for this good service is Mr. H. W. Clapp.

Mr. Clapp was formerly with several prominent American railroads. He left his home, Melbourne, when about twenty-five years old, to come to this country to study railroading. Three years ago he was asked to return to his home and take charge of the railways of Victoria. They comprise a system which employs 26,600 people and has over 5,000 miles of trackage.

All of the suburban roads out of Melbourne are electrified. When Chicago decided to electrify its terminal, she looked toward Melbourne, as Melbourne had a new, high voltage, up-to-date system similar to that which they contemplated installing. As an Englishman

remarked, "This system is even better than London's and yet on the other side of the globe." The progress of Australia is shown not only in Melbourne; for Sydney, with a population of 1,000,000 people, is building a complete subway system.

Melbourne's electrified system has been completed only in the last few years. Here again direct current was considered the best to use. No doubt all future electrification in Australia will be direct current. The voltage used there is 1,500 volts on overhead copper wires with all steel structural supports. The greatest drawback to the Victorian railways is the gauge used. It is not the standard gauge of 4 feet 8.5 inches as the transcontinental railway or the New South Wales railways, but 5 feet 3 inches. It is just a question of time until the commissioners will unify all odd gauges in Australia, which are very numerous and include all of the railways of Victoria.

The power is derived from one central station at present and distributed to the substations at 20,000 volts where it is stepped down through the transformers and changed on rotary converters to the direct current. From the substations it is fed into the line at various intervals by a unique distributing system. Most of the trackage is double except that for some of the inlying suburbs, a four-track system is used. Practically all trains go through the Flinter Street Terminal which handles on an average 2,600 trains and over 200,000 people per day.

The construction of the car bodies is not American. They are purely an English type built for Melbourne service. The seating arrangement in the suburban cars is similar to our Pullman cars with permanent seats facing both ways and a narrow aisle down the center. Each double seat has a sliding door beside it making nine doors on each side of the car. At each door there are seating accommodations for ten people, so the length of time it takes to load a train is based upon the time it takes ten people to go through a single door. The speed with which a train is loaded is quite remarkable. The train no sooner stops than the people rush in, the whistle is blown, and the standard seven-car train is off again. There is one main objection from the American point of view. That is, the door may be left open if desired, which is not "safety first." In fact, due to the

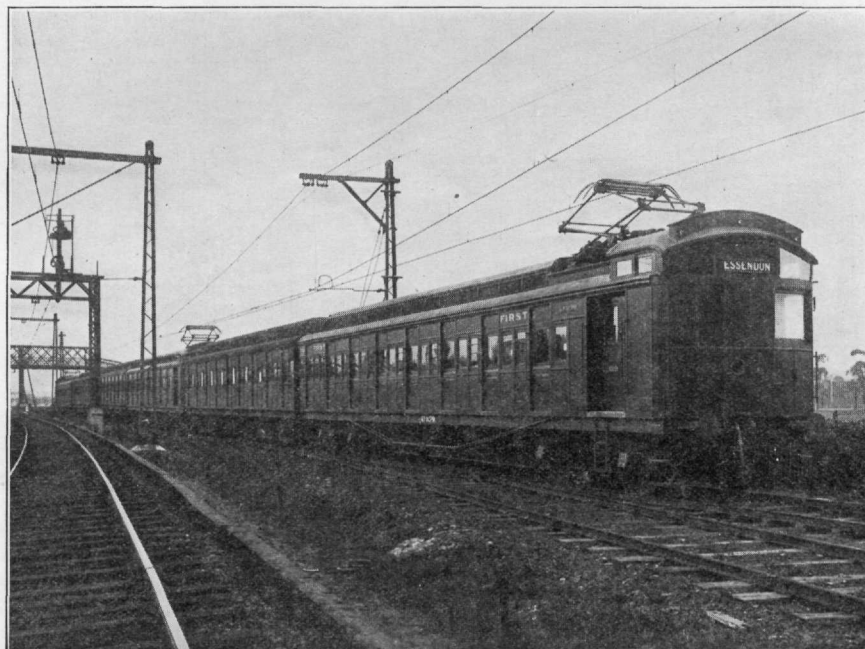
warm climate the doors are generally left open. This same principle usually is applied to the trams (street cars) and on account of their reduced speed people may get on or off of them when moving. The suburban cars equipped with motors have the American type truck and use two 140-horse-power motors per truck. Each motor is for 750 volts with the two motors on each truck connected permanently in series. These cars are equipped by one of America's largest electrical companies.

Particular note may be taken of the high voltage used with the over-head construction instead of half the voltage and a third-rail system. This is primarily the beginning of the electrification of the Victorian railways with a standard type of construction used throughout. The overhead work keeps all dangerous parts out of reach, a practice which is convenient in the open country as well as in the city. The high voltage adds to the distance the current can be sent efficiently.

All track outside of Melbourne and its suburbs is not electrified, so that the use of steam locomotives is required. For a few short lines gasoline cars have proved successful. The first thing the American notes is the size of equipment. The locomotives are quite small; the largest pull only about eight passenger cars. Each car does not weigh so much as one of ours. The freight cars have a standard capacity of 16 tons as compared with our standard of 50 tons. One would think that the Victorian railways are backward in steam railroading. They really are not, because due to the short hauls and small loads taken at each station, these trains are built for the local conditions.

Practically all locomotives, cars, and their equipment are manufactured at the Newport shops of the company which are located in Melbourne. Most all parts of the locomotives are built and assembled there. Great care is taken to obtain the best of workmanship. Even though small, the locomotives include superheaters, triple valve compressed air brakes, and other modern equipment and design. One of the large locomotives has been equipped for burning pulverized brown coal and has been operated very successfully. As brown coal is locally obtained at one-third the price of black coal, there is a strong possibility of converting all locomotives to burning this coal pulverized.

The construction of the freight cars is similar to ours



STANDARD ELECTRIC SUBURBAN TRAIN

except for the size and couplers. The cars are generally equipped with six wheels, two at each end and two in the center, each pair with its own suspension. An ordinary hook and link is now being used, but an automatic coupler is being considered seriously. No doubt in the near future the American type of coupler will be universally adopted as standard in Australia. For passenger cars a light construction is also used. Their standard truck of four wheels is located on each end of the car. The sleeping cars have a side entrance at each end with an aisle down the side of the car. A standard car has ten compartments, each with upper and lower berths extending across the car, and each containing a wash basin and clothes closet. The accommodations are very comfortable and private.

The electric car shops at Jollymont and the Newport general shops do not just repair but manufacture practically all equipment regardless of size and importance. This includes tools, keys, lamp fixtures, as well as electric and steam locomotives.

The Victorian railways are built with the best of workmanship and are suitable for their desired purpose. When the American sees the small steam trains and the large electric trains with many doors, he must realize that they are efficiently built to render the best service for their particular needs.

The Chief Commissioner, Mr. H. W. Clapp, realized the opportunity he had had, when a young man, to go to the United States to learn our methods of railroading, so he is continually sending young men for a period of from two to three years to work on our railroads. Filled with the spirit of American efficiency and service they return to adopt more modern methods where possible. This is only one of many ways that Mr. Clapp is building the great spirit of co-operation, not only among his employees but between them and the public. Another way is by showing a fine 7,000 foot film illustrating the development of the Victorian railways and irrigation projects and the many picturesque parts of Victoria which the railways serve.

The slogan of the railways to the public, "Help us to help you," carries with it the evidence of great co-operation which exists between the public and Victoria's largest successful business institution, the Victorian railways.

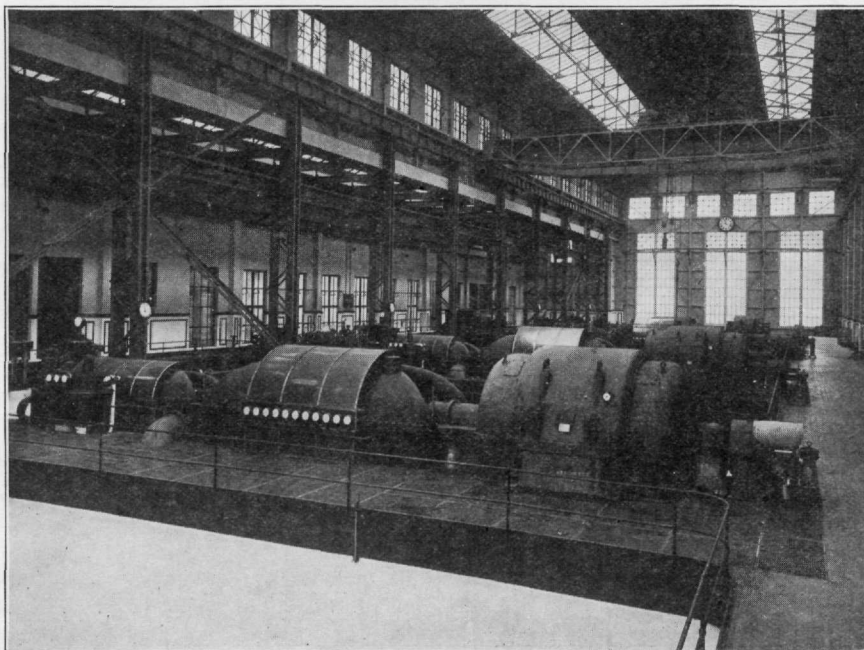
POWER DEVELOPMENTS

The Victorian railways obtain their power from the Newport power plant. Electricity for lighting and industrial power in Melbourne is also obtained from that plant as well as the city power plant. The use of electric power is increasing very rapidly. Two new units have just been installed in the Newport plant to accommodate present needs. The Electricity Commission realizing this need started the Morwell project in 1921 which will be in operation the first of next year. This plant will tie in with Newport and is the first of several plants to be built throughout the state. These plants taken together will ultimately develop into a super power system. All future plants will be located either at coal mines or water power sites.

The author had the pleasure of meeting the man in back of this great scheme, Sir John Monash, chairman of the Electricity Commission. He was formerly a civil engineer who has a fine personality and a great faculty for organizing. This was strongly brought forth in the World War, as at that time he was Lt. General in charge of the famous Australian armies.

The Newport power plant has an old and new section. The old section has six 10,000 kilowatt units, 1,500 revolutions per minute, generating 25 cycles at 3,300 volts stepped up to 20,000 volts for distribution. The new part has two 12,500 kilowatt turbo units of the bleeder type, 3,000 revolutions per minute, generating 50 cycles at 3,300 volts, also stepping up to 20,000 volts for distribution. This plant located on the bay has an unlimited supply of salt water for condensing purposes. Chain grate stokers are used, burning black coal under marine type cross drum sectionalized water tube boilers operating at a pressure of 250 pounds gauge. The new boilers use no economizers but heat the air delivered to the grates. At this power house an experimental plant is operated for drying and pulverizing the brown coal. Brown coal is found in large deposits and is mined with steam shovels at a cost of 50 cents a ton. It contains a great deal of moisture ranging from 50 to 70 per cent which is the serious objection to its use and making its value about 8,000 British thermal units.

Morwell, 90 miles east of Melbourne, is the site of the
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NEWPORT POWER PLANT

for cultivation, yet by reserving this water it is distributed onto the arid plains in the western part of the state.

In 1905 the State River and Water Supply Commission was formed and since then they have adopted a vigorous irrigation policy. The irrigation works draw their supplies mainly from the headworks construction on the Murray, Goulburn and Loddon rivers. The extent of land under irrigated culture for all kinds of crops during 1919 was close to 300,000 acres. The Murray is the largest river in Australia forming a boundary between Victoria and New South Wales and empties into the ocean through South Australia. This river is not as large as the Ohio River and is mostly supplied through the rainy season, becoming very low in the summer. This river is navigable by boats drawing six feet for a considerable distance up stream due to the locks at frequent intervals. It is customary to divert irrigation canals off at these locks.

VICTORIA, AUSTRALIA

(Continued from page 8)

largest brown coal deposit in the state. This deposit contains about 50 square miles and lies about 30 feet below the surface, being from 50 to 200 feet thick. Besides the large open mines operating there at Morwell a briquetting plant is being built which will produce 300 tons per day. This plant is of a German design and is being constructed by them as this coal is similar to the great brown coal deposits in Germany.

The largest feat however is the building of the power station. This station at present contains five units but ultimately ten. Each turbo unit is of the bleeder type, 12,500 kilowatt, 50 cycles, 3 phase, 3,000 revolutions per minute and generates at 11,000 volts. This voltage is stepped up through all outdoor equipment to 132,000 volts and transmitted by steel core aluminum wire supported on steel towers. Two transmission lines of three phase each run to Melbourne. The condensing water is obtained from a river beside the plant. Chain grate stokers are used under water tube boilers of 14,400 square feet of heating surface. It is a very modern type of plant of the latest design, the equipment of which is obtained mostly from Australia, England and the United States.

The island Tasmania is the only state that depends upon water power. Their large hydro plants develop practically all of the electrical power used. However in the future water power will be developed in Victoria and tied in with the Newport-Morwell system. Plans are being made for a system of power plants located at coal mines and water sites which will make a complete super power scheme throughout the state. On the completion of the Morwell project, in the next few months, the first large step will have been taken in the development of this great state-wide power undertaking.

This project will make the cost of electric power very reasonable; so Victoria, principally Melbourne, with good labor conditions, fine climate, and cheap power, will be an ideal location for the industries of Australia.

IRRIGATION

The great producing parts of Victoria depend entirely upon irrigation for their water supply. Most of the country that has abundant rainfall is too mountainous

Up stream many reservoirs have been built for controlling the flow of the rivers. One dam is being constructed at the junction of the Murray and Mitta rivers that is 4,000 feet long and 85 feet high. The lake thus formed will contain 1,000,000 acre feet of water and it will cover an area of over 47 square miles. This is by far the largest sheet of fresh water in Australia. The construction of most all dams are similar. As a general rule the dams are 1,000 feet long or more and about 50 feet high, made of earth and stone with a concrete spillway and entrance into the irrigation canal. Most all systems are gravity fed but in several places large pumps are used for lifting the water.

Where the fine Marino wool is grown, water is used mostly for just domestic purposes as the land usually has sufficient vegetation on it for sheep grazing. The squatter (rancher) uses about 12 inches of water per annum for his irrigation. From that he produces some of the finest fruit and small grains, principally wheat, in the world.

Australia, not having a large consumption, due to its small population, exports considerable grain, fruit, and other products such as flour and jam. Being so far away, its market must be the world, and its products must compete with the best. Victoria takes a leading part in Australia's exports with her products easily sold in London and New York.

SUMMARY

Australia's vast lands with a small population of its sturdy people, lies open to the miner, the farmer, and the engineer. Its personnel and equipment should be of the best for they are chosen from the whole world.

As all large engineering feats are government owned and controlled, the author wishes to speak of three men whom he had the great pleasure of meeting. They are: Sir Robert Gibson; the Right Honorable S. M. Bruce, Prime Minister of Australia; and the Honorable H. W. S. Lawson, Premier of Victoria. These three earnest business men are pushing vigorously the industries and engineering developments with the same spirit of devotion to progress as inspires the engineers of America.

This great island continent with its unlimited, undeveloped resources, and Victoria with its ideal conditions for industries lies open to all progressive engineers.